

# Ka'ū Preserve

## Hawai'i Island, Hawai'i

**Long-Range Management Plan  
Fiscal Years 2013-2018**



Submitted to  
**Department of Land & Natural Resources  
Natural Area Partnership Program**

Submitted by  
**The Nature Conservancy – Hawai'i Operating Unit  
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## EXECUTIVE SUMMARY

The Nature Conservancy of Hawai'i is an affiliate of The Nature Conservancy, an international private, non-profit organization based in Arlington, Virginia. The Conservancy's mission is to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. Since 1980, the Conservancy has directly helped protect more than 200,000 acres of Hawai'i's best natural lands and established a statewide system of 10 preserves totaling almost 36,000 acres. Today, we are taking conservation to a new level in Hawai'i by protecting the larger landscapes and biological systems of which our preserves are a part. Together with other public and private landowners, we are protecting over 1.6 million acres of ecologically important lands through voluntary, cooperative partnerships that allow landowners to share expertise and resources and work across ownership boundaries.

The State's Natural Area Partnership Program (NAPP) is an innovative program that aids private landowners in the management of their native ecosystems. NAPP provides matching funds (\$2 state to \$1 private) for the management of qualified private lands that have been permanently dedicated to conservation. TNCH is seeking reauthorization of NAPP funding for the next six-year period for the programs described within this *Ka'ū Preserve FY2013–FY2018 Long-Range Management Plan*. This plan continues the programs implemented under the previous plan and environmental assessments. Herein, we request \$675,132 over six years in matched state funds for the six years spanning FY2013–2018. Although the costs of the program have risen do to program growth and inflation, we are forgoing any increases in NAPP funding to state economic conditions. This plan was prepared in compliance with the NAPP agreement between the state, TNCH, and Hawai'i Administrative Rules Chapter 13-210.

The state Department of Land and Natural Resources (DLNR), which administers the NAPP, is kept apprised of our progress in the preserve through written reports and an annual inspection. Operational plans are submitted annually (the Conservancy has adopted a July 1–June 30 fiscal year). In addition, a six month semiannual report is sent to DLNR each February. These documents are available upon request to others who are interested.

The first section of this plan is a brief overview of the native natural resources that are protected at Ka'ū Preserve. In the second section are management considerations that have shaped our programs. Finally, each management program is discussed in turn. Program goals are followed by an explanation of the management method we have chosen. Annual objectives and costs for each program from FY2013–2018 are also listed.

We successfully implemented the resource management projects of the previous six-year long-range plan, as well as many others. See Table 1 and Appendix 1.

Table 1. Overview of Ka'ū Preserve Accomplishments by Program, FY 2007–2011 (5 years)

	Indicator	Measure of Success
Ungulate Control	Total pig catches	33 pigs
	Total hunts conducted	44 hunts
	Miles of fence installed and maintained	6 miles maintained annually
Invasive Plant Control	Acres and total numbers of priority invasive plants treated or removed	362 acres
Resource Monitoring	Frequency of ungulate sign on ungulate transects	Reduction from 80 to 0 percent ungulate sign on transects
Rare Species Protection and Research	Number of new rare taxa locations discovered	2 new rare plant species, 2 rare bird species, 1 rare mammal species
	Number of species outplanted and recovered	4 rare or endangered species
	Number of research projects supported in Ka'ū	7 invertebrate or plant studies 2 forest bird studies 1 palynology study 1 native mammal study
Outreach	Total volunteer hunts coordinated	28
	Numbers of visitors or public educated	1,000
	Numbers of volunteers	400
	Total volunteer hours	2,000

In 2007, TNC staff installed nine kilometers of ungulate transects both in the preserve and adjacent Ka'ū State Forest Reserve. The initial data showed ground disturbance in 72% of the area surveyed, with 80% for stations in Kaiholena unit alone. After the 1,200 acre ungulate fence was completed, successful eradication efforts resulted in zero ungulate sign within the fenced area since January 2009. To maintain these gains, routine fence checks are conducted on a bi-weekly basis and all breaches caused by tree fall repaired.

Construction of the six mile Kaiholena ungulate fence stands as our most important project to date, having resulted in significant regeneration of the understory. Native seedlings and mosses have filled in former wallows and pig trails, and species usually observed growing epiphytically such as *Trematolobelia wimmeri* and *Lobelia hypoleuca* have carpeted open sections of trail along the fence.

The hunter access program has resulted in 28 hunts which has effectively reduced ungulate pressure outside of the fence unit and provides for a productive outreach opportunity between TNC staff and Ka'ū hunters.

Over the next six-year period, we will focus on the following programs and goals. Details are discussed in each program section:

1. **Ungulate control** – The Nature Conservancy's primary management activity in Ka'ū will be to maintain forest integrity, reduce erosion, and limit weed invasion by reducing ungulate levels through use of standard management tools. Pigs are the primary targets of our removal programs, while mouflon sheep, goats, and Axis deer will also be targeted if they occur in the preserve. Innovative technologies will be used to achieve these management goals using real-time gps tracking collars, cellular-linked game cameras, and remotely operated traps. Ungulate monitoring transects will be read to measure the success of our techniques, and presence of pig sign will be documented during routine field operations.
2. **Invasive Plant Control** – The goal of this program is to control high priority invasive plants in the preserve, and prevent the introduction and spread of problem weeds to areas where they are not currently established. As part of our routine management program, the Conservancy will survey for and maintain maps of habitat-modifying weeds and initiate control at strategic locations. Priority weed control areas along the Ka'ū Forest Reserve's lower boundary will be identified and controlled in collaboration with the TMA watershed plan.
3. **Resource Monitoring** – Monitoring is imperative to providing data that can be used to guide management programs at Ka'ū Preserve. Our goal is to monitor changes in the integrity of the ecosystems in and around the preserve and to determine whether critical threats to those ecosystems are increasing or decreasing. We will use these data to gauge the effectiveness of our conservation strategies. Aerial imagery collected over the past few years will be analyzed and priority areas for control identified.
4. **Rare Species Protection and Research** – To date, five rare plant species, five rare bird species, and the endangered Hawaiian hoary bat have been observed in Ka'ū Preserve. Additional rare species reported from adjacent lands and similar habitats are likely to be found in Ka'ū Preserve with future surveys. Our goal is to prevent the extirpation of rare species in the preserve and to encourage research, predator control, and captive propagation of rare plant and bird species. Protecting habitat essential to the majority of the preserve's native plants and animals will be our primary protection strategy. We will also assess threats to the rarest species and take measures to protect them, as needed. Staff will also search for rare plant populations during routine management activities, and rare species maps will be updated on a periodic basis.
5. **Community Outreach** – The main objective of our outreach program is to increase awareness of the Ka'ū Preserve, the Ka'ū watershed and native ecosystems, and to help people understand their importance, threats to them, and efforts to protect them. More specifically, we seek to encourage and facilitate active participation and community pride among the residents of the Ka'ū District in the effective conservation of this

special resource. The key strategies for our public outreach include a variety of potential programs, including: environmental education, summer intern and youth employment, volunteer opportunities, guided trips, community meetings, and hiking and hunting programs.

6. **Watershed Partnerships** – The Nature Conservancy is a member of, and our preserves are included within, the Three Mountain Alliance, an extension of the Ola'a-Kīlauea Partnership. The members of this Alliance (consisting of federal, state and private organizations) have coordinated information gathering, management planning, community outreach, and on-the-ground conservation action. Our goal is to facilitate further development of the Three Mountain Alliance and help to implement initiatives that address the top watershed, forest, and biodiversity threats.

## **RESOURCES SUMMARY**

### **General Setting**

Ka'ū Preserve (Figure 1) was established by The Nature Conservancy in 2002 to protect biologically rich and intact forest. It was purchased by the Conservancy from a subsidiary of C. Brewer & Co. Ltd., who had owned the lands for over 100 years. It is contiguous to and within the external boundaries of the State's Ka'ū Forest Reserve on the southeast flank of Mauna Loa volcano, upslope from the coastal agricultural area between Wai'ōhinu and Pāhala in the Ka'ū District of Hawai'i Island. The 3,511-acre Preserve, which includes four separate units, is positioned within one of the largest areas of intact forest land in the State, totaling 68,500 acres.

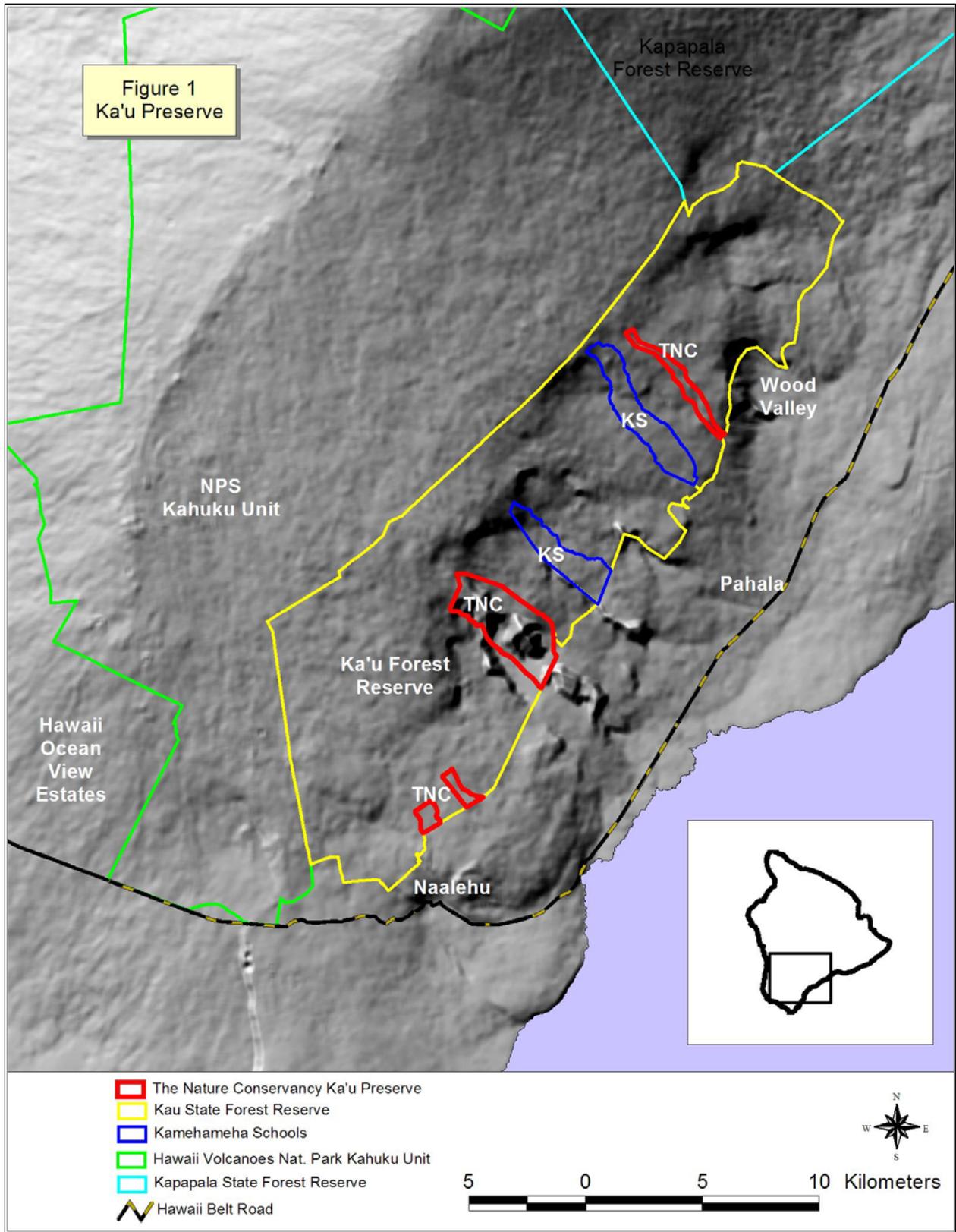


Figure 1. Ka'u Preserve

## Flora and Fauna

### ***Native Natural Communities***

There are four native-dominated natural communities in the Ka'ū Forest Reserve, and all four are also represented in Ka'ū Preserve:

1. Koa/'Ōhi'a Montane Mesic Forest is present at the highest elevation portion of the Keaīwa unit,
2. Koa/'Ōhi'a Montane Wet Forest covers the middle portion of the Keaīwa unit,
3. 'Ōhi'a Montane Wet Forest covers the lower portion of the Keaīwa unit and the upper portion of the Kaiholena unit, and
4. 'Ōhi'a Lowland Wet Forest covers the lower portion of the Kaiholena unit and all of the Kāhilipali and Kī'olokū units (Figure 2, Appendix 2).

The very high quality of the wet and mesic forest communities in Ka'ū provides a rare opportunity to implement management before it is too late or costly.

On Hawai'i, **Koa/'Ōhi'a Montane Mesic Forest** is the habitat of the endangered Hawaiian broadbean (*Vicia menziesii*) and a number of rare plant taxa, including members of the genera *Clermontia*, *Phyllostegia*, *Stenogyne*, and *Melicope*. This rare forest type is often important habitat for endangered forest birds. Protected examples of this community are in the Hakalau National Wildlife Refuge and Manukā Natural Area Reserve on Hawai'i, and the Kuia Natural Area Reserve on Kaua'i.

**Koa/'Ōhi'a Montane Wet Forest** occurs on the islands of Kaua'i, Maui, and Hawai'i and is not considered rare. This moderately imperiled forest type has a good representation of 'ōhi'a and are often rich in native forest birds and invertebrates.

**'Ōhi'a Montane Wet Forest** is one of the most widespread wet forest communities in the Hawaiian Islands. This community type is moderately imperiled, and some occurrences are known to include rare plants, birds, and invertebrates. It is often important habitat for endangered forest birds. The steep slopes of the Kaiholena unit contain a subtype of this community called Wet Cliff, dominated by a mix of ferns and shrubby 'ōhi'a.

In Ka'ū, the **'Ōhi'a Lowland Wet Forest** is floristically similar to the 'Ōhi'a Montane Wet Forest immediately above it in elevation. This community type is moderately imperiled and provides habitat for rare native plants. It is typically not important habitat for endangered forest birds on Hawai'i Island due to the presence of mosquitoes associated with its lower elevation. The lower portions of the Kāhilipali and Kī'olokū units contain a subtype of this community, 'Ōhi'a/Uluhe (*Metrosideros/Dicranopteris*) Fern Forest, which is composed of a nearly continuous blanket of uluhe (*Dicranopteris linearis*) with emergent and widely spaced 'ōhi'a trees. See Figure 2.

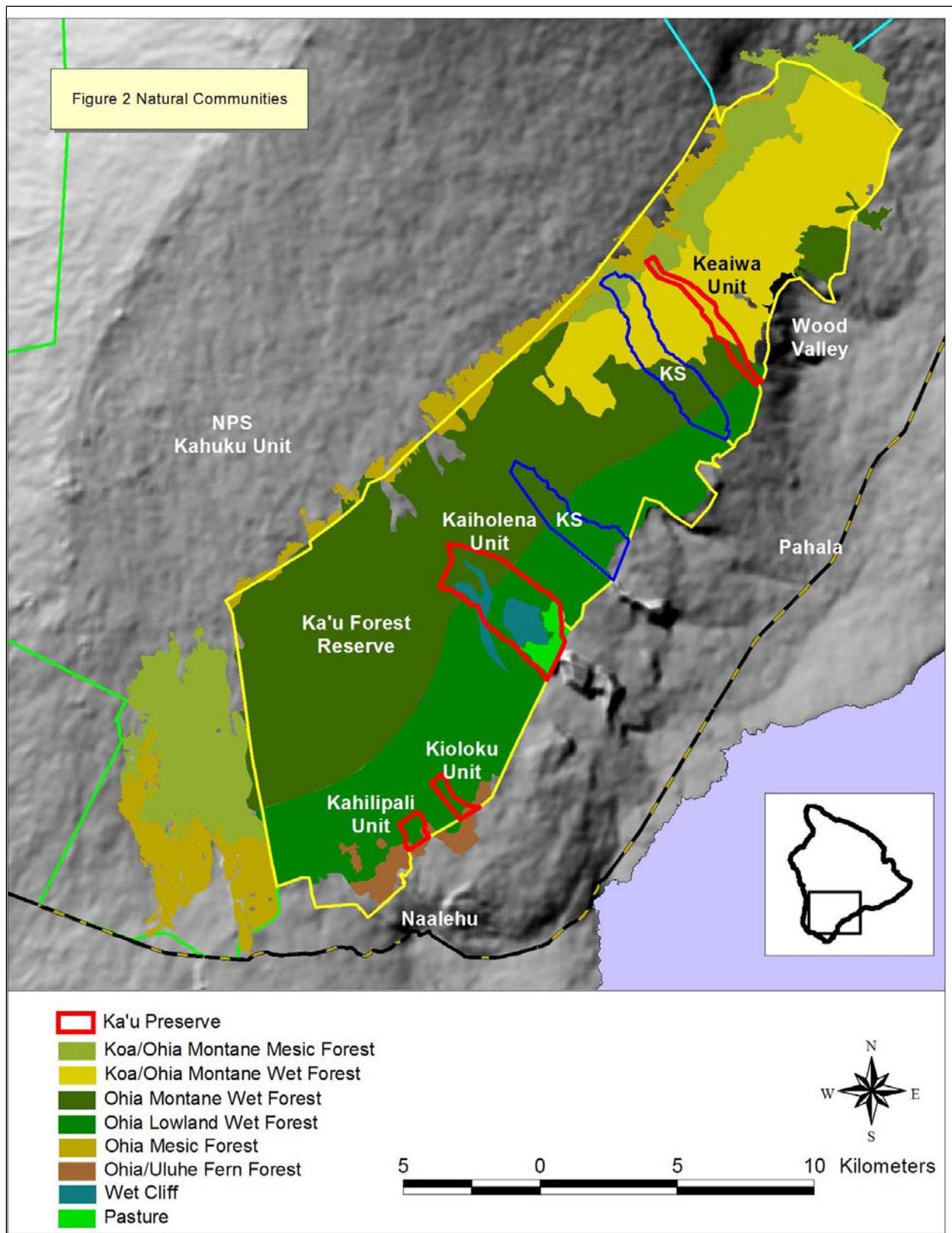


Figure 2. Natural communities of Ka'u Preserve

## **Native Flora**

From a statewide perspective, the southeast portion of Mauna Loa (eastern side of the Southwest Rift Zone), is surpassed only by East Maui in the number of different types of ecosystems present. Considering all of its nine ecosystems, this region is home to more extant, endemic species of flowering plants (178 species) than any other region of Hawai'i Island. In fact, its mesic and wet forest ecosystems alone support 153 endemic plant species. While Ka'ū Preserve does not contain the full diversity of species found within the region, the majority of the lands are very high quality. A list of native plants that occur in the Kaiholena unit is now being developed (see Appendix 3 for a draft listing of native plants).

The mesic and wet forests of the Ka'ū region are home to at least 12 known species of rare plants (Appendices 4 and 5). Six of these are endangered, two are candidates for listing as endangered, three are species of concern, and one has a restricted range.

Data for rare plants and animals in Ka'ū come from widely-spaced survey transects, very few of which actually fall within the preserve. Much of the rest of the land, within and outside the preserve, has not been surveyed but almost certainly harbors more rare elements.

Five rare plant species have been observed in Ka'ū Preserve. Three species, *Cyanea tritomantha* (candidate), *Nothoestrum breviflorum* (listed endangered), and *Phyllostegia vestita* (species of concern) have been reported within the Kaiholena unit: *C. tritomantha*, last observed in Kaiholena in 1912 and *P. vestita*, last observed in Kaiholena in 1961, have never been reported within the nearby Ka'ū Forest Reserve. Two additional species have been observed in the Kaiholena unit by TNC staff: *Trematolobelia wimmeri* (species of concern) and *Lobelia hypoleuca* (restricted range).

Many of the plants that occur on Conservancy lands in Ka'ū are not listed in the State or Federal Register in any of the categories that may make them rare; however, plants like *Strongylodon ruber*, *Charpentiera obovata*, and *Touchardia latifolia*, are rare on Hawai'i Island and/or rare from a population standpoint and will be treated as such with regards to rare species management for this plan. Subpopulations of *Pritchardia lanigera* near Kaiholena were last observed in 1980 and were thought to be extirpated. However three small subpopulations were recently located by TNC staff working with local hunters and volunteers. These subpopulations should be considered endangered.

## **Native Terrestrial Fauna**

One of the richest assemblages of rare or endangered forest birds inhabit the largely intact forests of Ka'ū. Five endangered forest birds have been reported in the wet and mesic forests of Ka'ū (Appendices 6 and 7). Of these, all have been reported within Ka'ū Preserve: the 'Io or Hawaiian Hawk, the Hawai'i 'Ākepa, 'Ākiapōlā'au, the Hawai'i Creeper, and the Hawaiian Crow or 'Alalā, historically found in Ka'ū but now probably extirpated.

Endangered Hawaiian hoary bats, 'ōpe'ape'a, have also been observed on the preserve, inhabiting the wet montane forests of Ka'ū and likely roost, forage, and breed in the preserve (USGS).

Few native invertebrates have been given endangered status, and are generally very poorly understood, but the intact natural communities of Ka'ū no doubt include hundreds of native invertebrates, the majority of which are endemic to the archipelago, and several of which are likely endemic to the Ka'ū region.

## MANAGEMENT

### Management Considerations

1. Our primary management focus is to prevent degradation of the native forest by reducing feral ungulate damage, limiting the spread of non-native, habitat-modifying plants, and preventing the introduction of other invasive species. We are also committed to improving community outreach and to continue providing access as required by law for people who want to use the preserve in ways that will not degrade its natural resources.
2. The preserve is divided into four separate units spanning a distance of 12 miles (Figure 3). Each unit shares three boundaries with the State's Ka'ū Forest Reserve, and one boundary with a private landowner who purchased the properties from Ka'ū Agribusiness, a subsidiary of C. Brewer. As a result of sharing the southern (lowland) boundary with private agricultural lands, public access via unimproved roads is somewhat limited, and we carefully coordinate our management and interpretive activities with work in these adjacent agricultural areas.
3. Although the threat of fire is somewhat diminished due to the high level of precipitation on the preserve (approximately 60-120 inches annually), the proximity of the units to paved roads increases the possibility that a fire could start either accidentally or intentionally and affect the Preserve, particularly after a period of drought. Our participation with the Three Mountain Alliance includes working on a fire initiative with the other Alliance members.
4. The acquisition of Kahuku Ranch by the National Park Service (NPS) creates a mosaic of Ka'ū lands, with four principal landowners, all sharing a mandate for conservation and management of Hawai'i's natural resources: The Nature Conservancy, NPS, the State Department of Land and Natural Resources, and Kamehameha Schools. This provides the foundation for collaborative management at the watershed level as an effective way to address shared management challenges and opportunities.
5. There is potential to provide additional public access to the Forest Reserve and the preserve at several points along their lower boundaries, as most access roads are not open to the public at this time. Roads that are currently used by the public to access Ka'ū watershed lands include: Hā'ao Springs Road, Mountain House Road and Lorenzo Road. Access into the upper areas of the preserve is limited by difficult terrain and a lack of roads and trails, so helicopter access is necessary.
6. There is a high level of interest regarding forest management in Ka'ū from various groups of people living near the preserve. This provides a rationale for coordinated community outreach and functional partnerships that promote compatible uses of the

forest (e.g., environmental education, recreation, native gathering, hunting, rare species conservation).

7. As provided by law, appropriate access to the preserve for traditional practice will help to mitigate the perception of decreased access. Three gates are available for preserve access on the Kaiholena side and fence step-overs have been installed where needed; the locations were determined in consultation with the community.

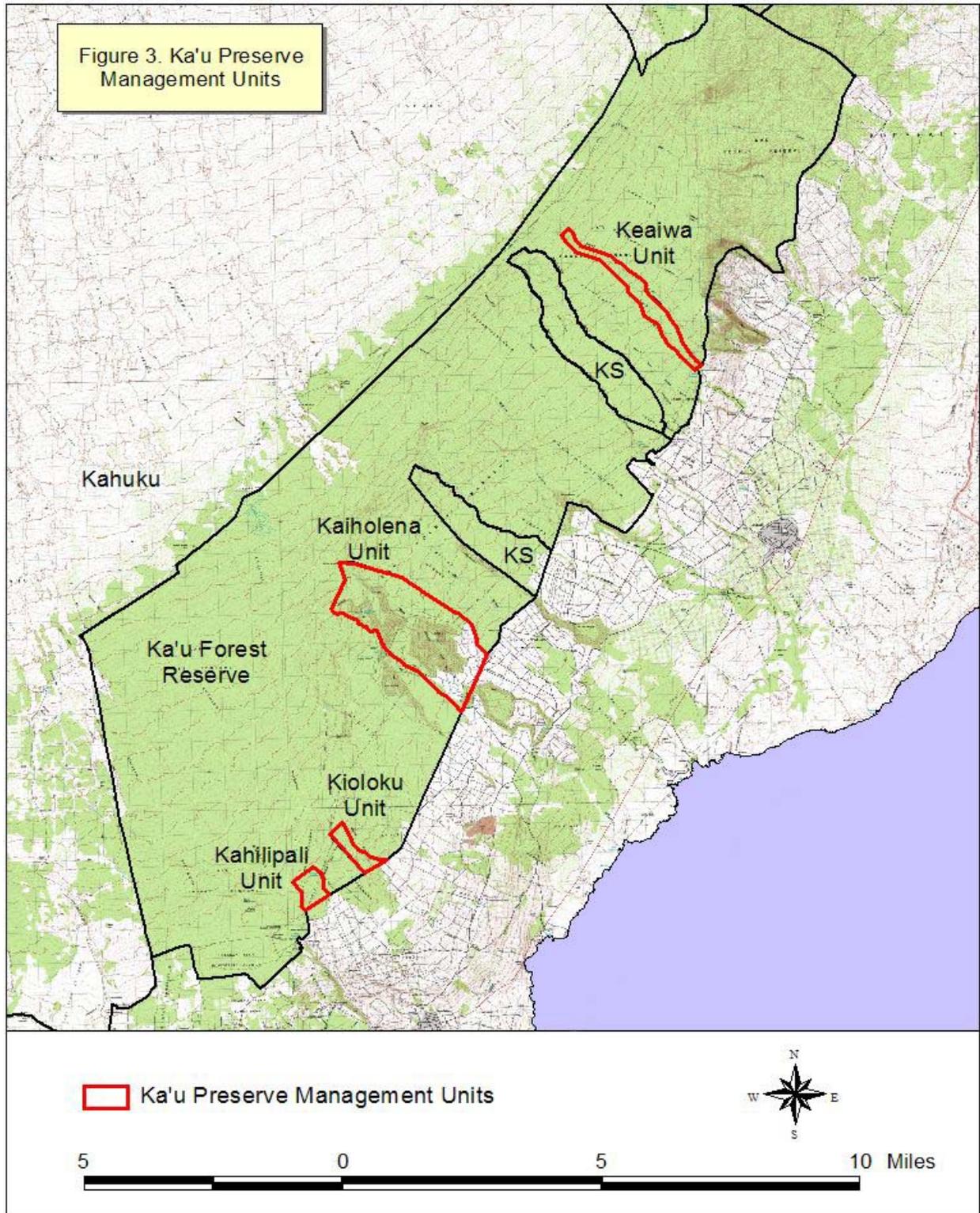


Figure 3. Ka'ū Preserve management units

## Management Areas/Units

Ka'ū Preserve is divided into four separate units: Kāhilipali, Kī'olokū, Kaiholena, and Keaīwa (Figure 3).

1. The Kāhilipali unit is the smallest (169 acres) and westernmost unit, accessed via the 4WD Mountain House Road. The elevation ranges from approximately 2,400 to 2,640 ft. The annual precipitation is 2,000 mm (79 in). A portion of this unit is zoned Agriculture and the rest is zoned for Conservation (subzone: Resource). Most of the unit contains 'Ōhi'a Lowland Wet Forest, however the forest in the lower portion of the unit grades into the community subtype 'Ōhi'a /Uluhe Fern Forest. Portuguese Springs is located in the upper northeast corner, at the head of Alapa'i Gulch, which runs along the northeast boundary of the unit. A maintained pipeline diagonally traverses the middle of the unit providing a corridor for non-native invasive plants such as guinea grass (*Panicum maximum*), sourbush (*Pluchea carolinensis*) and bamboo orchid (*Arundina graminifolia*), and more serious weeds such as strawberry guava (*Psidium cattleianum*), Koster's curse (*Clidemia hirta*), and Christmas berry (*Schinus terebinthifolius*). Glorybush (*Tibouchina urvilleana*) occurs along the Mountain House Road.
2. The Kī'olokū unit is the next largest (211 acres) and is located approximately one mile north of the Kāhilipali unit. The elevation ranges from approximately 2,400 to 2,700 ft. The annual precipitation is 2,000 mm (79 in). The lower portion is accessed via ranch roads, while the upper elevation is accessed via the 4WD Mountain House Road. Waiaele Gulch runs along a portion of the northeast boundary of the unit. The forest, like the Kāhilipali unit, is mainly 'Ōhi'a Lowland Wet Forest, with some areas of 'Ōhi'a/Uluhe Fern Forest. Glorybush (*Tibouchina urvilleana*) occurs along the Mountain House Road, and weeds such as strawberry guava (*Psidium cattleianum*) and Koster's curse (*Clidemia hirta*) are present in the forest. This unit is zoned for Agriculture.
3. The Kaiholena unit is the largest (approximately 2,620 acres) and is centrally located four miles from the Kī'olokū unit and six miles from the Keaīwa unit. A pu'u (hill or mount), Kaiholena, rises sharply from its base elevation of 2,000 ft to a height of 3,723 ft and is geologically much older than the surrounding, more gently rolling Mauna Loa flows. Just northwest of the Pu'u Kaiholena, Pu'u Makaalia rises to a height of 4,240 ft. Hīlea Gulch runs between these two pu'u. Old Plantation Springs, a portion of whose water rights are held by the previous owner, is nestled in the southern folds of Pu'u Makaalia at approximately 3,500 ft. The annual precipitation is 2,000 mm (79 in) except for a wetter area on the south side of Pu'u Kaiholena which has 3,000 mm (118 in) annual precipitation. A portion of this unit is zoned Agriculture and the rest is zoned for Conservation (subzones: Protective and Resource).

Directly south of Pu'u Makaalia lies Pu'u One (3,220 ft elevation), on State land just outside of the Kaiholena unit boundary. Historically this pu'u was considered with the

others as all one place. The western side of Pu'u One is accessed via a 4WD road that leads to a gauging station on one branch of Hīlea Gulch.

The forest in the lower portion of the Kaiholena unit is 'Ōhi'a Lowland Wet Forest, becoming 'Ōhi'a Montane Wet Forest at approximately 3,200 ft elevation. Five rare plants have been reported in this unit. Very few weeds have established in Kaiholena. Those present and still controllable include Japanese anemone (*Anemone hupehensis*), palm grass (*Setaria palmifolia*), and strawberry guava (*Psidium cattleianum*). *Tibouchina herbacea* is present along the Pu'u One access road. There are 315 acres of former cane land at the base of the Pu'u Kaiholena which have been converted to pasture and are now leased by a local rancher for cattle grazing. The incipient population of silk oak (*Grevillea robusta*) has been eradicated from the pasture.

4. The Keaīwa unit is the second largest (511 acres) and easternmost unit. Keaīwa Reservoir (on State land) lies at the base of the unit at approximately 3,000 ft elevation. From there the unit stretches mauka. A 6 km-long strip of land, the Keaīwa unit is only 570 m wide at its widest point. Its northern boundary (5,700 ft) is approximately 1 km from the Kahuku unit of Hawai'i Volcanoes National Park. The annual precipitation in the lower portion of the unit is 3,000 mm (118 in), in the middle portion is 2,000 mm (79 in), and in the upper portion is 1,500 mm (59 in). Pi'ikea and Kā'ala'ala Gulches meander in and out of the Keaīwa unit. The uppermost portion of the unit (above 5,300 ft) contains Koa/'Ōhi'a Montane Mesic Forest (50 acres), while much of the rest of the unit consists of Koa/'Ōhi'a Montane Wet Forest, except for lower third of the site (below 4,000 ft) which is 'Ōhi'a Montane Wet Forest and the bottom 50 acres (below 3,400 ft) which are 'Ōhi'a Lowland Wet Forest. The endangered forest bird, Hawai'i 'Ākepa, has been reported in this unit, observed between 4,000 and 5,000 ft elevation in 1995. Several highly invasive plants occur near the Keaīwa Reservoir, including night-blooming jasmine (*Cestrum nocturnum*), Japanese anemone (*Anemone hupehensis*), and strawberry guava (*Psidium cattleianum*). The nearby village of Wood Valley (2 km away) is heavily infested with plume poppy (*Bocconia frutescens*), and the community there is also in the process of eradicating an incipient population of coqui frogs. This unit is zoned for Conservation (subzone: Protective).

## Management Programs

### *Program 1: Ungulate Control*

**Program Goal:** To reduce ungulate (cattle, pigs, sheep, goats, and axis deer) damage from an additional 1,200 acres of the Kaiholena Unit and in the Kāhilipali, Kī'olokū, and Keaīwa Units.

**This program represents an estimated 30% of the overall effort and budget in this long range management plan.**

Survey transects completed in 2007 showed pig activity and extremely high levels of ground disturbance by pigs in all 123 stations of the Kaiholena Unit. Additional surveys conducted in the Keaīwa Unit and parts of the Ka'ū Forest Reserve show extensive, severe ground disturbance by pig activity. Diminished diversity of groundcover and understory species has been observed over large areas. In some severely impacted parts of the forest, common groundcover and understory plants are persisting only epiphytically upon trees and tree ferns. Weed surveys conducted in the Kaiholena Unit show a direct correlation between presence of weed species and pig activity. High levels of ground disturbance, coupled with reduced groundcover, have led to an increase in water runoff, sheet erosion, and stream bank collapse. There is also a very high likelihood of wild cattle, mouflon sheep, and feral goats in the vicinity.

Of the four Ka'ū Preserve units, the largest expanse of intact, high-quality native lowland wet forest and most significant biological resources (rare plants and high native diversity) occur in the roughly 2,600-acre Kaiholena Unit. Therefore, Kaiholena was chosen for the first fencing effort in the Ka'ū Preserve. A fence was completed in 2007, enclosing 1,200 acres. Over a period of two years, 33 pigs were removed during 44 hunts, conducted by volunteer hunters, contracted experts, and TNC staff. The last pig was removed by TNC staff in January of 2009.

The final cost of this fence totaled \$397,866 and was subcontracted out to Sunshine Fencing. Funding for fence construction was secured through the USDA Natural Resources Conservation Service's Wildlife Habitat Incentives Program (NRCS WHIP), which provided 75% of the cost. The rest of the cost was covered by TNC and a portion matched with NAPP funds.

Large areas of the Ka'ū Preserve units remain unprotected, however. Relying on public hunting, aerial shooting, staff hunts, and other means to reduce feral animal populations instead of fenced enclosures is not a feasible alternative because as long as areas remain unfenced, feral animals will continue to enter them from adjacent lands. Animal removal would have to continue indefinitely. This long-term control program would be expensive and unpopular, and make the goal of natural resource protection and rare plant reintroduction impossible. The best long-term solution is therefore to build additional fenced areas, and remove all feral ungulates as quickly as possible.

However, constructing fences that enclose all four Ka'ū Preserve units is not cost-effective or feasible at the present time. The Kāhilipali and Kī'olokū units are isolated, small (169 and 211 acres, respectively), and somewhat degraded by invasive plants. Therefore fencing these units would not result in a significant enough contribution to resource protection from ungulates to justify the expenditure of funds that fencing would require. The Keaīwa unit (511 acres) is a "spaghetti" parcel with elongated dimensions: 6 km long by 500 m wide. Although significant biological resources are present, particularly in the upper elevation, we are not proposing to construct fences in this unit at the present time. However, the acceptance of this 6-year plan does not preclude the re-consideration of this possibility in the future.

Working with our partners to implement large scale fencing in the upper Ka'ū State Forest will remain the operational focus for the duration of the six-year plan, and no new fences are proposed within the TNC preserve at this time. However, fence alignment surveys have been completed which would protect an additional 1,100 acres above the existing Kaiholena fence unit, and should unanticipated funding sources become available, this project would be a priority in years 3-6 of this LRMP. There is also an opportunity to work with a landowner adjacent to Kaiholena preserve who is in the process of placing 340 acres of native forest into a conservation easement. Should the landowner pursue management of this area, TNC could provide the alignment survey and provide technical expertise as to best management practices.

In the unfenced units, as well as the unfenced portions of the Kaiholena unit, our objective is to reduce ungulate damage by enhancing hunter access (by installing signs, check-in stations, etc.) and encouraging public hunting in these areas through outreach. A back-country camp consisting of two canvas tent cabins is in the upper reaches of the Kaiholena unit. This enables staff to have a dry place to camp overnight while conducting surveys, monitoring, and constructing fence. These tents are also available for hunters to use. Permanent ungulate activity monitoring transects have been installed in these units and will be monitored periodically for detection of changes in ungulate activity level.

Additionally, in cooperation with the NPS, the State, and Kamehameha Schools, a site survey for optimum large-scale ungulate fencing will be conducted (see Watershed Partnership Program). Strategies to remove ungulates from remote areas and to enhance ungulate hunter access will be identified and implemented.

#### Ungulate Control Program Activities

##### Years 1-6 (FY2013 - FY2018)

- Maintain 6 miles of preserve fences on a bi-weekly schedule
- Continue hunter access program at Kaiholena

##### Year 1 (FY2013)

- Facilitate large-scale ungulate fencing in upper Ka'ū forest planning process through community outreach, field surveys, and ungulate removal

Year 2 (FY2014)

- Assist DOFAW/State in site survey for optimum ungulate fencing

Years 3-6 (FY2015 – FY2018)

- Facilitate implementation of large-scale ungulate fencing in upper Ka'ū forest
- Assist with ungulate removal in upper Ka'ū forest
- Source funding for optimum placement of additional fences in Kaiholena unit

***Program 2: Invasive Plant Control***

**Program Goal:** To control high priority invasive plants in the preserve, and prevent the introduction and spread of problem weeds to core areas of native habitat where they are not currently established.

**This program represents an estimated 30% of the overall effort and budget in this long range management plan.**

Habitat-modifying weeds are non-native plants that have demonstrated the ability to suppress regeneration of and/or displace native vegetation. Many weeds become established when an area is disturbed by ungulates, which may also carry and spread seeds. Elimination of ungulates, therefore, may be one of the most effective means of controlling the introduction and spread of many habitat-modifying weeds in the preserve. To complement these efforts, our invasive plant control program focuses on removing habitat-modifying weeds that are already established in the preserve.

The presence of several serious invasive plant species both on and in the vicinity of the preserve has been identified (Table 4). In the past six years we completed a systematic, preserve-wide inventory, survey and mapping effort to identify the location and extent of weed infestations. Priority weed maps and a species- and unit-specific management plan are in place as of October 2006. Management efforts will continue to be prioritized according to feasibility of control, proximity to sensitive core areas of the preserve, and along corridors leading into the preserve.

Table 2. Known Pest Plants of Ka'ū Preserve

<b>Common Name</b>	<b>Scientific Name</b>
Christmas berry	<i>Schinus terebinthifolius</i>
Glorybush	<i>Tibouchina urvilleana</i>
Japanese anemone	<i>Anemone hupehensis</i>
Night-blooming jasmine	<i>Cestrum nocturnum</i>
Palm grass	<i>Setaria palmifolia</i>
Silk oak	<i>Grevillea robusta</i>
Strawberry guava	<i>Psidium cattleianum</i>
Common guava	<i>Psidium guajava</i>
Kāhili ginger	<i>Hedychium gardnerianum</i>

Results of the weed survey show a large infestation of strawberry guava and *Clidemia* in the Lower Hīlea subunit of the Kaiholena unit. This infestation required immediate attention, and 140 acres above the core area were cleared of habitat-modifying weeds in the past six years. The total area cleared of invasive plants in and adjacent to the preserve is 362 acres (Figure 4). Work in Year 1 will involve continuing to attack the infestation from the upper edge (using herbicide) working towards the core. A large infestation of *Tibouchina urvilleana* is located in the Kī'olokū unit. Aerial surveys have been conducted and were followed up with ground surveys. The extent of the infestation is greater than we first anticipated and the discovery of Kāhili ginger in the unit prompted immediate control of the priority species. Ginger control will continue to be the priority management goal in this area.

We strive towards an Integrated Pest Management (IPM) approach to weed control — consisting of manual/mechanical methods, herbicides, and/or biological control. As biological controls are developed and approved for release on our top priority weeds, we will work cooperatively with agencies mandated to monitor these agents. Cultural control (minimizing soil disturbance and new pest plant introductions) is incorporated into routine field operations through gear sanitation protocols. Herbicide use is in full compliance with the State of Hawai'i Department of Agriculture (HDOA) Pesticide Enforcement Division, used according to the product label, and recorded in detail for reference and efficacy monitoring. Staff coordinating weed control are certified with the HDOA Pesticide Enforcement Division through a Forestry Applicators' exam and card. We may employ other techniques or tools for weed control as they are developed. Any new application methodology used regularly will be coordinated in full compliance with HDOA.

Staff and visitors will follow strict procedures to prevent the inadvertent introduction of invasive plants while working or hiking in the preserve. Our invasive species prevention protocol calls for inspecting all clothing and equipment for seeds before entering the preserve. We will remain vigilant in our search for incipient populations of invasive plants. Species such as fireweed (*Senecio madagascariensis*), Himalayan raspberry (*Rubus ellipticus*), cat's claw (*Caesalpinia decapetala*), and plume poppy (*Bocconia frutescens*) are found nearby but do not occur on the preserve. *Miconia calvescens*, which has extensively invaded Hilo and Puna up to 3,500 ft elevation, has not been reported in Ka'ū.

Other invasive pests and pathogens (e.g., coqui frogs, gall wasps, koa wilt) will be diligently surveyed for so that they can be detected as early as possible and responded to rapidly before they are able to gain a foothold. Rats will be controlled on a site-specific basis, as needed for the protection of rare plants.

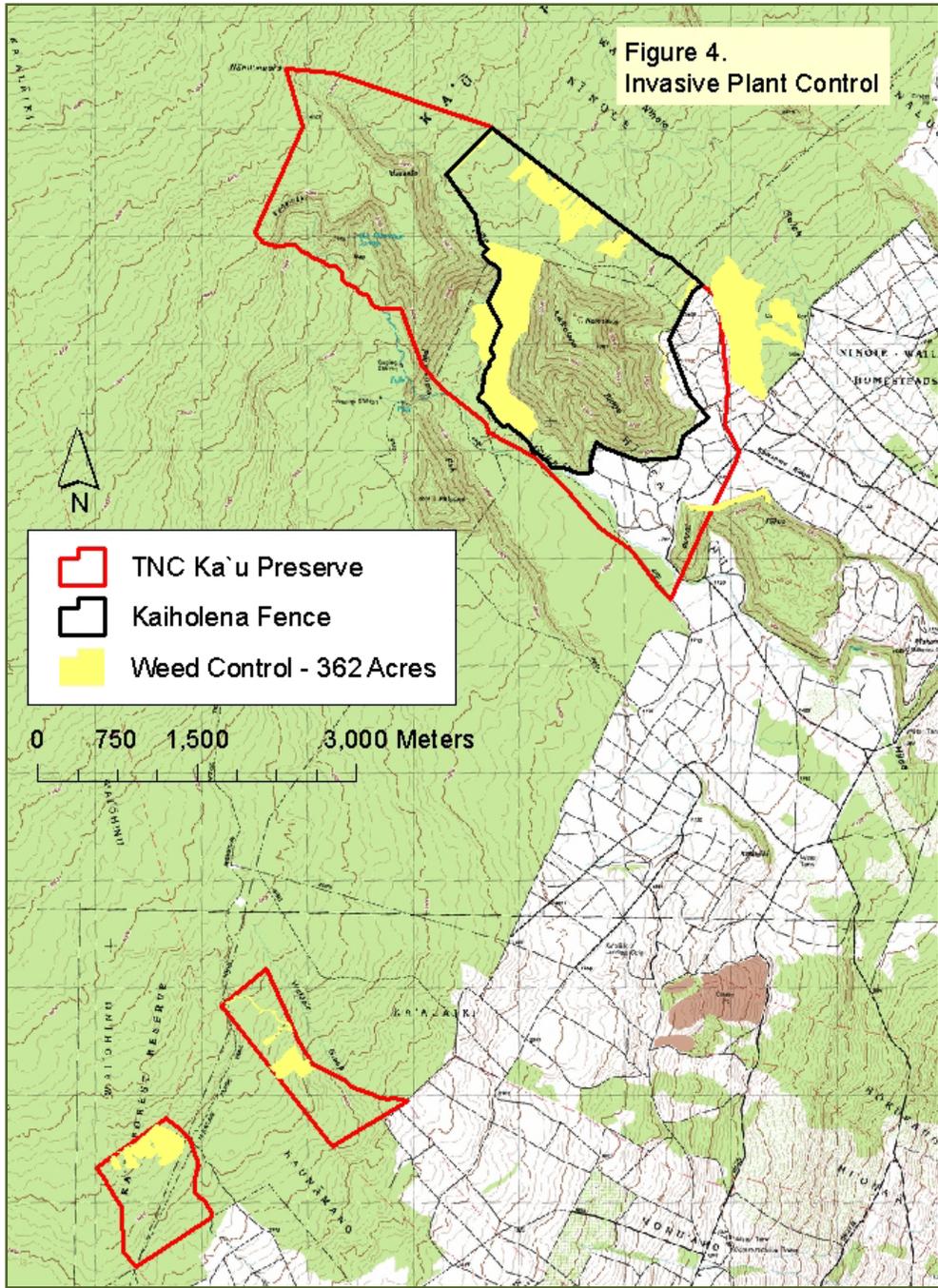


Figure 4. Invasive plant control in Ka'u Preserve, FY2007-FY2011

## Invasive Plant Control Program Activities

### Year 1-6 (FY2013 - FY2018)

- Maintain priority weed maps
- Monitor effectiveness of treatments
- Continue adaptive management of weeds and adjust strategies as needed based on monitoring results
- Continue to participate as a member of BIISC
- Continue strict inspection and cleaning procedures to prevent introduction of weed species not currently in the preserve

### Year 1 (FY2013)

- Work with TMA and BIISC to prioritize the most serious invasive weeds and geographic areas

## ***Program 3: Resource Monitoring***

**Program Goal:** To monitor changes in the integrity of the ecosystems in and around the preserve; to determine whether critical threats to those ecosystems are increasing or decreasing; and ultimately to gauge the effectiveness of our conservation strategies.

**This program represents an estimated 5% of the overall effort and budget in this long range management plan.**

As an organization, The Nature Conservancy is trying to develop a more consistent and rigorous approach to evaluating the success or failure of our conservation actions. We have established a preliminary framework for assessing the effectiveness of our conservation actions based on the level of critical threats and on several key characteristics of the native ecosystems most greatly affected by them.

At Ka'ū Preserve and vicinity, we continue to monitor critical threats as above by tracking changes in ungulate activity and the extent of habitat-modifying weeds. In particular, we propose to measure the indicators in Table 3.

Ungulate activity levels will be measured periodically on transects as discussed previously. The number, location, and sampling scheme for these transects will remain consistent with the past six years of data collection. Innovative approaches to real-time ungulate monitoring and removal will be implemented as a best management practice. Data collected on these transects provide an index of ungulate activity and should indicate the level of success of ungulate removal efforts. In addition, field staff will also create activity maps from field observations showing the presence of ungulate sign whenever it is detected. This information will direct our ungulate removal efforts where they are needed most.

High priority invasive plant species will be mapped opportunistically during all field operations and systematically when needed. Treated populations will be monitored to determine effectiveness of treatments.

Ecosystem extent, adjacent land use patterns, and canopy condition will be assessed through analysis of aerial imagery and/or maps produced. Much of this data has been collected by way of an aerial mapping contract for the preserve and along the lower forest edge. The quality of this imagery allows resource managers to see between gaps in the canopy to a resolution of 2 cm, potentially revealing weed populations in areas where field survey would prove to be too costly or too dangerous to attempt.

Vegetation understory and diversity will continue to be assessed using ground-based methods and through contracting of field botanists. This monitoring may coincide with ungulate monitoring across landscape transects, or may entail other sampling methods. Specific sampling schemes, frequency of monitoring, and data collection methods will be determined during the first several years of the implementation of the management plan. Pilot studies at other Conservancy sites (e.g., East Moloka'i) will help to inform the development of this monitoring component.

In addition, we will continue to work with the Division of Forestry and Wildlife (DOFAW) to monitor forest birds according to the agency's statewide schedule (approximately every five years). The last Ka'ū bird census was in FY2007. The bird data are maintained and analyzed by the USGS Biological Resources Division. Conservancy staff and cooperators will also document incidental observations of rare birds observed while in the preserve.

Table 3. Planned Monitoring Framework for Ka'ū Preserve and Vicinity

Threat Factors	Indicators
<b>Ungulate activity</b>	Frequency of ungulate sign
<b>Extent of habitat-modifying weeds</b>	Extent of specific weed species
<b>Key Vegetation Attributes</b>	
<b>Extent of ecosystem or natural community</b>	Acres of ecosystem or natural community
<b>Adjacent land use</b>	Percentage of ecosystem boundary adjacent to lands managed for threat reduction or biodiversity conservation
<b>Vegetation canopy condition</b>	Percentage of native canopy cover
<b>Vegetation understory condition</b>	Percentage of native vegetation cover in understory Percentage of native vegetation cover in ground layer
<b>Diversity of indicator plant species</b>	Percentage and frequency of native, indicator plant species in understory and ground layer

## Resource Monitoring Program Activities

### Year 1 (FY2013)

- Continue ungulate monitoring transects in all four management units
- Continue weed mapping and identification of highest priority weeds
- Determine methods for monitoring efficacy of weed treatments
- Determine vegetation monitoring methodology

### Years 2-6 (FY2014 - FY2018)

- Continue ungulate and weed monitoring
- Continue weed mapping and identification of highest priority weeds
- Analyze threat data and adjust management actions as needed
- Determine and/or implement vegetation monitoring as necessary
- Facilitate Forest Bird Surveys, following DOFAW's schedule

## ***Program 4: Rare Species Protection and Enhancement***

**Program Goal:** To prevent the extirpation of rare species in the preserve, and to encourage research, predator control, and captive propagation of rare plant and bird species.

**This program represents an estimated 5% of the overall effort and budget in this long range management plan.**

TNCH uses data from the U.S. Fish and Wildlife Service, the agency responsible for administering the federal Endangered Species Act, to identify rare and endangered species and those that are listed as “candidate” or “special concern” species. Biological surveys have shown that the preserve protects numerous rare species, many of which are federally listed as endangered (Appendices 2-7). Additional rare species reported from adjacent lands and similar habitats are likely to be found in Ka’ū Preserve with future surveys.

Protecting ecosystems essential to the majority of the preserve's native plants and animals will be our primary management strategy. Our ungulate and weed control programs are integral to the protection of these ecosystems and rare species. In addition, we will supplement our understanding of the types and ranges of rare plants and animals with surveys to locate other rare species and assess their status, and to document all incidental observations of rare plants, birds, bats, and invertebrates while in the preserve. We will encourage research and provide logistical support to partners interested in specific rare species research and protection efforts.

Rare plant surveys will be conducted in Years 1 and 2. Rare species protocols will be implemented, including securing seed collection permits and working with the Volcano Rare Plant Nursery to deliver any seeds collected for future use (either by TNC or by the State for future outplanting in the same general area). A portion of the NAPP funds will be used to

support the Rare Plant Nursery to offset their expenses in maintaining and propagating any collected seeds.

Fencing will continue to be installed as needed to protect populations of rare plants from ungulates. Rat control will be conducted as needed.

#### Rare Species Program Activities

##### Years 1-6 (FY2013 – FY2018)

- Protect and monitor rare plant populations
- Continue implementing rare species protocols
- Rare plant enhancement plans may include small enclosure fences of less than 10 acres around endangered species (see Ungulate Program for fence specifications)

##### Years 1-2 (FY2013 – FY2014)

- Conduct rare plant surveys in upper Ka'ū forest

### ***Program 5: Community Outreach***

**Program Goal:** To build Ka'ū community understanding and support for the preservation of Ka'ū's native forests, and enlist volunteer assistance for preserve management.

#### **This program represents an estimated 15% of the overall effort and budget in this long range management plan.**

The main objective of our outreach program is to build upon the foundation built with the local community and to continue to increase awareness of Ka'ū Preserve, the Ka'ū watershed and native ecosystems, their importance, threats, and efforts to protect them. More specifically, we seek to encourage and facilitate active participation and community pride among the residents of the Ka'ū District in the effective conservation of this special resource. The key strategies for our public outreach work include a wide variety of programs, including: partnering with organizations on environmental education, employing summer interns, hosting volunteer days, guiding walks in the preserve, attending community meetings, participating in local events, and working with hunting programs.

The focus audience will continue to be the children of Ka'ū (elementary and high school), the adults of the community, and community leaders. Discussions with teachers at Pāhala and Nā'ālehu schools have occurred and strategies to implement on-site educational programs are being explored. An interpretive nature trail in the Kaiholena unit continues to be a wonderful tool for showing people healthy native forest. Field activities will combine a mix of conservation projects and educational opportunities. Conservation projects will include trail construction and maintenance, invasive plant control, fencing, and biological monitoring. Educational activities will address a wide variety of land management, cultural history, and natural history topics.

## Community Outreach Program Activities

### Year 1-6 (FY2014 – FY2018)

- Continue community outreach and volunteer program
- Continue University of Hawai'i at Hilo and Hilo Community College service workdays
- Continue to work closely with partners in communicating conservation goals to the Ka'ū community
- Expand the environmental education program to other Conservancy parcels and to other landowners in the region

### Year 1 (FY2013)

- Facilitate community outreach objectives in line with broader upper Ka'ū forest management plan

## ***Program 6: Watershed Partnerships***

**Program Goal:** To assist the long-term effective management of the native ecosystems of the Ka'ū region by participating in the Three Mountain Alliance, a coordinated partnership of landowners and other partners.

### **This program represents an estimated 15% of the overall effort and budget in this long range management plan.**

The Three Mountain Alliance comprises four landowners who are responsible for managing nearly 250,000 acres of contiguous lands in the Ka'ū region — the National Park Service, the State of Hawai'i, The Nature Conservancy, and Kamehameha Schools. These landowners and additional partners (e.g., U.S. Geological Survey, U.S. Forest Service, U.S. Fish and Wildlife Service) have committed to the need for a coordinated approach to information gathering, management planning, and community outreach. By participating in a watershed partnership, the Conservancy is reducing the threats to Ka'ū Preserve while leveraging funding by having partners.

Because the Conservancy has worked in the Ka'ū forest for almost a decade, we are able to provide our partners and the community with a unique perspective on the current condition of the forest, the range and habits of invasive ungulates, and technical support in selecting a location and design for the fence. We have longstanding relationships with community members and will be able to find consensus among a wide range of stakeholders. Our Geographic Information Systems (GIS) staff has the capacity to provide high-quality maps and our communication team can prepare for public hearings where community members will have the opportunity to share and discuss their concerns.

The Nature Conservancy's goal is to collaborate with our state and federal partners through science input, planning, and community outreach to support a fencing project in the Ka'ū forest, which would be funded through USFWS. If successful, this project will catalyze conservation throughout the entire forest, but the key will be creating and implementing a plan that will be welcomed by stakeholders in the community.

A detailed plan for the fence is currently being developed, and the Conservancy is working with the National Park Service, Three Mountain Alliance, Kamehameha Schools, USFWS, and DOFAW to ensure the plan is well-defined, executable, and well-received by the community. Our long-term goals for the project include the following:

- Complete a forest fence plan and associated Environmental Assessment (EA);
- Implement a community outreach plan to ensure approval of the plan and EA;
- Work with partners to ensure funding is appropriated and the first phase of the fence construction is initiated in core habitat;
- Complete an ungulate control strategy that will allow public or volunteer hunting for up to six months after completion of the fence;
- Work with partners to gain support for long-term zero tolerance ungulate control; and
- Complete aerial weed and baseline vegetation mapping of the project area.

TMA has joined the Big Island Wildfire Coordinating Group (BIGWIG) and continues to encourage other landowners to participate. This is a good venue for communication because fire response agencies are all represented, including DOFAW and the County of Hawai'i.

As mentioned in the Ungulate Control Program description above, TNC also intends to increase public access to allow for public hunting. In support of the overall regional management, there would also be increased access to Ka'ū for DOFAW management of the Ka'ū Forest Reserve (e.g., access along the roads to the base of Pu'u One (Kaiholena unit), and access through the Kī'olokū and Kāhilipali units along the Mountain House Trail or other existing road networks).

#### Watershed Partnership Program Activities

##### Year 1-6 (FY2013 – FY2018)

- Support priority management activities developed by the Three Mountain Alliance

##### Year 1 (FY2013)

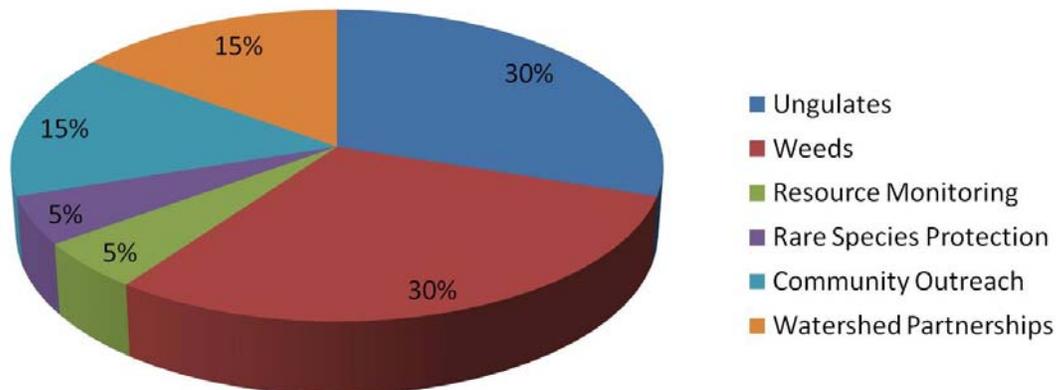
- Continue to work with partners to gain support for long term ungulate control

##### Year 2-6 (FY2014 – FY2018)

- Promote DOFAW's adoption of a forest access plan for greater public hunting access along lower boundary of-Ka'ū Forest Reserve

## BUDGET SUMMARY

### Ka'ū Preserve FY2013–FY2018 Budget Allocations



The table in the next section summarizes the six-year budget for the Ka'ū Preserve NAPP project. Through the NAPP program, the state pays two-thirds of the management costs outlined in this long-range plan and TNC funds (from private and other government sources) the remaining one-third.

The Conservancy's Ka'ū operation maintains a full-time base staff of two. Other part-time, short-term, or year-to-year personnel, in addition to staff overtime, are covered in this budget and will be utilized as project needs warrant. Technical and annual planning support is primarily provided by both the Honolulu office of the Conservancy. As budget and needs allow, these support staff members may charge a small portion of their time to this project. The Nature Conservancy's annually negotiated fringe benefits rate will also accrue on all salary costs.

This budget includes NAPP renewal costs such as an Environmental Assessment and Cultural Impact Assessment, project-related supplies, subcontract expenses to conduct fence checks/maintenance and weed/ungulate control, and other miscellaneous project-related costs including vehicle expenses both as equipment purchases and equipment leases. The Conservancy routinely provides trainings for staff to improve job performance, and in addition to these trainings, supervisory staff regularly attend meetings in Honolulu. Travel and training

funds are included within this budget to cover airfare, board and lodging, and training expenses.

An overhead rate is included (subject to slight change each year) to recognize the Conservancy's indirect costs for facilities, accounting, legal, and other administrative support. Although the Conservancy's overhead rate is currently 22.53% (the annual rate changes each year per negotiations with DOI), the NAPP program will currently pay only 10%, leaving the remainder as a portion of the Conservancy's one-third match.

Budgetary Constraints: This Ka'ū NAPP budget represents a slight reduction in funding since the last LRMP (2007–2012). As such, TNC has modified deliverables in some areas to accommodate the lower funding amount. Should TNC receive significant private funds in addition to the NAPP funds, we hope to complete additional management activities. This will depend entirely on TNC's statewide priorities and its ability to raise additional funds. We will report on progress on all accomplishments in Ka'ū Preserve and on adjacent lands regardless of funding source.

## BUDGET TABLE

	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	TOTAL
Labor & Benefits	117,296	112,848	122,623	128,627	134,873	111,367	727,634
Contractual	33,000	13,000	9,000	9,000	9,000	9,000	82,000
Communications	0	0	0	0	0	0	0
Travel	3,000	3,000	3,000	3,000	3,000	3,000	18,000
Supplies	15,000	15,000	15,000	15,000	15,000	15,000	90,000
Other	500	500	500	500	500	500	3,000
<i>Subtotal</i>	<i>168,796</i>	<i>144,348</i>	<i>150,123</i>	<i>156,127</i>	<i>162,373</i>	<i>138,867</i>	<i>920,634</i>
Overhead	16,880	14,435	15,012	15,613	16,237	13,887	92,064
<b>TOTAL</b>	<b>185,676</b>	<b>158,783</b>	<b>165,135</b>	<b>171,740</b>	<b>178,610</b>	<b>152,754</b>	<b>1,012,698</b>
	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Year 6</b>	<b>Total</b>
Ka'ū Budget	185,676	158,783	165,135	171,740	178,610	152,754	1,012,698
Private Match (1/3 of total)	61,892	52,928	55,045	57,247	59,537	50,918	337,567
<b>TOTAL NAPP REQUEST (2/3)</b>	<b>123,784</b>	<b>105,856</b>	<b>110,090</b>	<b>114,493</b>	<b>119,073</b>	<b>101,835</b>	<b>675,131</b>

# Appendices

## Appendix 1. Ka'ū Preserve accomplishments, FY2007-FY2011

### NAPP LRMP Accomplishments FY 2007-2011

#### Goal 1 - Ungulate control

To eliminate ungulates (cattle, pigs, sheep, and goats) from the Kaiholena Unit by 2012 and to reduce ungulate damage in the Kāhilipali, Kī'olokū, and Keaīwa Units.

#### Pu'ū Kaiholena

- 2007** Completed in November 2007, the fence enclosed over 1,200 acres of high-quality native forest, including that found on Pu'ū Kaiholena and also protects the culturally significant Iholena Banana patch. The ungulate fence is 7 feet tall, high enough to exclude mouflon sheep. This was the first mouflon-proof fence in the state found in forested habitat.
- 2007** Public hunting continued as the fence was being constructed.
- 2008** Built five kennels for maintaining hunting dogs for use on the Ka'ū Preserve.
- 2008** Professional ungulate eradication contract commenced; TNC hunters to be trained in WOD hunting method.
- 2009** TNC staff remove final four pigs from Kaiholena unit.
- 2008-2011** Maintain Kaiholena fence by checking for breaches once per week, clearing fallen debris as needed, and checking once a week for ingress.

#### Repair and upgrade existing fence

- 2007** Cattle fence through the pasture was replaced by ungulate-proof fence.
- 2008** Pig-excluder fence at Kamehame rebuilt, protecting Hawksbill nesting habitat.

#### Enhance ungulate hunter access to the Ka'ū forest

- 2007 - 2011**
- Kaiholena Unit access roads on the Ka'ū Preserve improved and maintained and open for public hunting on either TNC or adjacent state land.
  - Ka'ū staff assist hunters with the purchase of hunting licenses online at the field office and coordinate hunting access.
  - Continued planning for a Forest Access road with cooperation from State Watershed Planner and adjacent landowners that would increase hunter access along the forest edge from Kāhilipali to Kaiholena preserves. Plan completed in 2011.
- 2007** Worked with DOFAW representatives to determine what can be done to improve access to the lower Ka'ū Forest Reserve.
- 2009 - 2010** Four fence step-overs that allow easier access for land managers and community members to the Ka'ū Forest Reserve adjacent to Kaiholena.
- 2010** Legal easement in use at Kaiholena to facilitate new grazing lease and hunter access.

- 2010 State Forest Reserve sign installed in Upper Hīlea at top gate (coordinated with Steve Bergfeld, DOFAW).
- 2011 Vehicle and equipment shed construction completed at Kaiholena.
- 2011 Radio repeater at Kaiholena equipment procured and site located.

**Back country access**

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- 2008 Landing zones were installed on Pu'u Kaiholena and at the back of Makaalia.
- 2008 - 2009 Backcountry camp site on Makaalia was selected, cleared and constructed.
- 2009 Pursue installation of a helicopter landing zone in the upper elevations at Keaīwa. Found an adequate opening in the forest above the Keaīwa unit, on NPS land, so there is no need to install a landing zone. Located an additional forest opening in the Ka'ū FR northwest Pu'u Makaalia which can be used as an LZ.

**Goal 2 - Invasive Plant Control**

To control high priority invasive plants in the preserve, and prevent the introduction and spread of problem weeds to core areas of native habitat where they are not currently established.

**Prioritize the most serious invasive weeds and geographic areas within the Ka'ū Preserve**

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- 2007 Roughly 30% of the Kaiholena unit has been intensively surveyed for weeds (excluding the pu'u and pasture areas). Portions of the Kāhilipali, Kī'olokū, Keaīwa units and the forest edge have also been surveyed. These surveys revealed the presence of 41 weed species on the Ka'ū Preserve, eleven of which were classified as high priority taxa for removal.
- 2007 Priority weed maps completed for Kaiholena, Kāhilipali, and Kī'olokū parcels.
- 2008 Priority weed map completed for Keaīwa.
- 2008 Ka'ū Preserve Weed Plan drafted.
- 2009 Assisted BIISC with development of early detection program and strategy for roadside survey in Ka'ū District.

**Weed sweeps**

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- 2007-2011 Scout for and treat weeds in the pasture management unit, in the course of regular management activities.
- 2007 With the help of volunteers, satellite populations of high priority weeds have been controlled on 28 acres in the Kaiholena parcel.
- 2008 Weed sweeps of target species in East Kaiholena, Lower Hīlea, and Upper Hīlea management units on 33 acres.
- 2008 We cut and sprayed over 6,600 mature kahili ginger (*Hedygium gardnerianum*) stalks and almost 200 keiki of kahili ginger on roughly 5 acres in Kāhilipali Unit. Surveys will continue in the coming year.
- 2008 Finished survey of forest edge (via helicopter) from Pu'u Kaiholena east to Kapāpala; create map of the night-blooming jasmine infestation in the Ka'ū Forest Reserve just east of the Kaiholena unit.
- 2008 With the help of the DOFAW and the 'Ōla'a Kīlauea Project (OKP) crew, the night-blooming jasmine (*C. nocturnum*) control was very successful! Given seven days (April 14-17, 21-23 - 2008) with DOFAW and three days (August 25, 27-28 - 2008) with the OKP, we covered approximately 103 acres within the Ka'ū Forest Reserve adjacent to the Kaiholena Unit
- 2009 Finished construction of work shed (located in the pasture) with assistance from volunteers, including the Hawai'i Youth Conservation Corps.
- 2009 Surveyed and controlled over 70 ac of high priority weeds in the Kaiholena unit: 32 ac in East Kaiholena, 29 ac in Upper Hīlea, and 10 ac in Lower Hīlea.
- 2009 Detected and removed one Australian tree fern (*Cyathea cooperi*) from Pu'u Iki in the south corner of the unit.

- 2009** Conducted initial weed survey and control work in Keaīwa Unit, including mapping scattered individuals of Japanese anemone (*Anemone hupehensis*), sourbush (*Pluchea caroliniensis*), and butterfly bush (*Buddleia asiatica*).
  - 2009** Surveyed and controlled two very small clumps of kahili ginger (*Hedychium gardnerianum*) along the flume trail near the Keaīwa Unit (on private property adjacent to the unit).
  - 2009** Continue night-blooming jasmine control work in the Ka'ū FR adjacent to the Kaiholena unit. Initial monitoring of the 125-ac night-blooming jasmine control area (treated in FY08) showed 100% efficacy of control methods.
  - 2009** Surveyed and controlled 5 ac of kahili ginger in Kāhilipali and surveyed Kī'olokū units.
  - 2010** An additional 8 acres of Kāhilipali ginger control sweeps were completed.
- Survey and control work was initiated on the kahili ginger population in the Kī'olokū unit with 23 acres surveyed so far. Small individual ginger plants were found and removed.
- 2010** Surveyed and controlled 15 ac of high priority weeds in East Kaiholena.
  - 2010** Controlled an isolated 3-acre patch of night-blooming jasmine in East Kaiholena.
  - 2010** Contracted survey and control of high priority weeds in the Ho'awa Ridge area of Lower Hīlea, creating a 72-ac buffer between the core infestation and surrounding area. Found and treated: 734 strawberry guava; 111 *Clidemia hirta*; 557 *Tibouchina herbacea*; 268 *Passiflora* spp.
- 2007 - 2011** Participate as a member of the Big Island Invasive Species Committee (BIISC).
  - 2007-2011** Continue strict inspection and cleaning procedures to prevent introduction of weed species not currently in the preserve and built a check-in kiosk at the entrance of the Kaiholena Unit.
  - 2009** Finished construction of work shed (located in the pasture) with assistance from volunteers, including the Hawai'i Youth Conservation Corps.
  - 2010** State Forest Reserve sign installed in Upper Hīlea at top gate.
  - 2010** Target all weeds along roadside and lower boundary of Keaīwa Unit.

### **Goal 3 - Resource Monitoring**

To monitor changes in the integrity of the ecosystems in and around the preserve; to determine whether critical threats to those ecosystems are increasing or decreasing; and ultimately to gauge the effectiveness of our conservation strategies.

- 2007-2011** Several transects have been established in Kaiholena, including one that traverses through TNC land on one side of the fence into State FR on the other. This transect will enable comparison between ground disturbance levels inside and outside the fence.
- 2007** Priority weeds were mapped and baseline conditions recorded priority to commencement of treatment.
- 2008** Landscape-scale understory monitoring conducted in Ka'ū forest.
- 2008** Ungulate monitoring transects at Kaiholena (including the one installed in the Ka'ū Forest Reserve – outside of the Kaiholena Hilo side boundary) have been kept up to date. Data has been collected every six months. A transect has been installed in the Kāhilipali Unit and have plans to install transects in Kī'olokū and Keaīwa.
- 2009** Installed an ungulate monitoring transect in the Kī'olokū unit. Low levels of disturbance were observed in a few plots.
- 2008-2009** Data on pig dispatches reported by public hunters at Kaiholena were entered into an ungulate database by the Natural Resource Manager. Many catches were marked with a GPS point.
- 2009** Hunting sweeps made by the contract hunter were tracked with GPS to ensure complete coverage.
- 2009** State coqui frog control crew monitored Kaiholena. No frogs observed.

#### Goal 4 - Rare Species Protection and Research

To prevent the extirpation of rare species in the preserve, and to encourage research, predator control, and captive propagation of rare plant and bird species.

##### Surveys

- 2007** A rare plant survey was conducted along the proposed Kaiholena fence alignment on March 23 and 30. Rare species surveys continued on May 15-17, 2007 when a single individual *Pritchardia* palm (loulou) was observed from the air within the interior eastern boundaries of Kaiholena. Although no rare species were found on either survey, populations of uncommon native plants were located and mapped.
- 2007** Conduct native invertebrate surveys. Documented the presence of moths in the genus *Omiodes* (Lepidoptera: Crambidae). Field surveys and light trapping efforts in the preserve produced four species of *Omiodes* moths: *O. accepta*, *O. localis*, *O. monogona*, and *O. blackburni*. The latter species is unique in that it feeds on Polynesian cultivars of banana, a plant that was introduced within the last 1,500 years. It is presumed that the introduction of bananas triggered the divergence of this species from a palm-feeding ancestor. Over 100 *O. blackburni* caterpillars were collected from the leaves of a Hawaiian variety of wild banana growing on the slopes of Kaiholena.
- 2008** Audubon Society's Christmas Bird count completed in Ka'ū.
- 2008-2009** The National Tropical Botanical Garden's Ken Wood conducted a rare plant survey in the Keaiwa unit. The objectives of the survey were to a) evaluate the ecology of the region; b) compile a checklist of all vascular plant taxa observed within the unit; and c) map all discoveries of rare plants. Rare plant species *Lobelia hypoleuca*, *Stenogyne macrantha*, and *Trematolobelia wimmeri* were observed. In addition, three endangered honeycreepers were heard during the trip: Hawai'i 'Ākepa, Hawai'i Creeper, and the 'Akiapōla'au.

##### Outplant rare species & protect and monitor rare plant populations

- 2009** TNC staff located three small populations of mature *Pritchardia lanigera* at Kaiholena. Netting was placed under the trees and seed collection is on-going. Seeds were transferred to the Volcano Rare Plant Facility, where they are being raised for outplanting on the Ka'ū Preserve.
- 2009** Continued to monitor outplanting of the endangered *Phyllostegia vellutina*, *Pritchardia lanigera*, and *Clermontia montis-loa*. (Note: the nearest known natural population of *P. vellutina* occurs 3.5 km northwest of the outplanting site, in similar habitat. Last observed in 1912.)
- 2009** Coordinated the collection of *Touchardia latifolia* propagules at Kaiholena by the National Park Service Restoration crew.
- 2009** Coordinated the collection of *Strongylodon ruber* propagules at Kaiholena by the Plant Extinction Program.
- 2009** Additional populations of species of concern *Trematolobelia wimmeri*, *Stenogyne macrantha* and *Lobelia hypoleuca* were found within the Kaiholena unit.
- 2009** Purchased fence materials to build small enclosures around rare plant populations found on unfenced unit
- 2010** All outplanted rare plants were monitored for survival. *Pritchardia lanigera* seedlings planted in 2008 showed a survival rate of 92%.
- 2010** An individual *Pritchardia lanigera* (in addition to known populations) was found within the fenced unit at Kaiholena during FY10 weed control sweeps.

##### Research facilitated on the preserve

- 2008**
- Survey of parasitic wasps within The Nature Conservancy's Ka'ū Preserve – Robert Peck.
  - Study of endemic bark lice in Hawai'i – Emilie Bess
  - Population trends and seasonal movements in the Hawaiian Hoary Bat – Frank Bonaccorso
  - Reproductive biology of the endemic Hawaiian Lobelioideae – Richard Pender (scoped out Kaiholena, research is pending).

- 2009**
  - Species radiation of native bark lice - Emilie Bess
  - Optimal growing conditions for Clermontia species - Justin Kunkle
  - Genetic studies on Clermontia species - Jennifer Johansen
  - Seed preferences of the 'Alala - Liba Prejchar and Susan Culliney
  - Native crickets - Kerry Shaw
  - Hawaiian hoary bat research, bat survey at Kaiholena - USGS
  - Parasitoid wasps - Bob Peck
- 2010**
  - Hawaiian hoary bat survey - USGS
  - Optimal growing conditions and genetic studies for Clermontia spp.,
  - Food preferences of the 'Alala, and reforestation of woodlots in pasture to enhance native bird habitat
- 2011**
  - Hawaiian hoary bat survey - USGS
  - Study on cricket species - Cornell University
  - Seed preferences of the 'alala
    - Pasture reforestation to enhance native bird habitat

### **Goal 5 - Community Outreach**

To build Ka'ū community understanding and support for the preservation of Ka'ū's native forests, and enlist volunteer assistance for preserve management.

- 2007**
  - Ka'ū staff led educational tours for a high school science class from Ka'ū High School.
  - Staff made a presentation to elementary students at Kamehameha Schools about how plants and animals arrive in Hawai'i without human assistance.
  - Blessing ceremony/grand opening party for the new Ka'ū field office in Nā'ālehu - over 150 community members and agency partners attended
  - Staff coordinated the Audubon Christmas Bird Count at Keauhou.
  - Teacher workshop at Kaiholena – use of GPS; presented field curriculum for teaching students about plant/animal dispersal to, and colonization of, Hawai'i; identifying native Hawaiian plants.
  - TNC staff presented at four community meetings on invasive plants threatening Ka'ū (See Invasive Plant Control Program).
  - Booth at Earth Day – carbon calculator demonstration; tour to Kaiholena for Pāhala Elementary school group.
  - Presentation to students at Aspen Institute Program: terrestrial ecosystems in Hawai'i; how to become a natural resource professional
  - Tour of Ka'ū for NPS/TREE Hawai'i's Alaska-Hawai'i keiki exchange student group
  - Ka'ū Preserve tour for student group from Imi O Ka 'Āina I Ka Pono
  - Ka'ū Preserve tour for student group from Nana I Ke Kumu O Ka'ū.
  - Ka'ū staff led close to a dozen tours to the Ka'ū Preserve for agency partners, donors, and community members.

- 2008**
- Kamehame Beach Volunteer Work Weekend – Replaced old and rusted ungulate proof fence behind the nesting area.
  - Agency partner, Lyman Perry from DOFAW was accompanied by Ka'ū staff on the Ka'ū Forest Reserve transect that was placed adjacent to TNC's Kaiholena Unit (outside of the fence).
  - Dennis LaPointe from USGS came out to Kaiholena to discuss potential projects relating to mosquitoes. TNC staff coordinated the Audubon Society's Christmas Bird Count at Keauhou in partnership with the 'Ōla'a Kīlauea Project.
  - Volunteer workday at Kaiholena in doing weed sweeps for high priority weeds. TNC hosted Roosevelt High School – AP Biology club at Punalu'u Beach Park for a beach clean-up and Kaiholena conducting weed sweeps.
  - TNC in partnership with 'Imi Pono no ka 'Āina Program, DOFAW, and DOE hosted a teacher's workshop at Kaiholena to discuss environmental education.
  - Volunteer workday at Kaiholena in doing weed sweeps for high priority weeds.
  - Participated at the UHH – Earth Day Celebration.
  - Presentation to Kea'au elementary students on natural resource management.
  - TNC staff hosted a field trip at Kaiholena with the Partnership for Reform through Investigative Science and Math (PRISM) Program from UHH for Nā'ālehu School 5th graders.
  - Initiated a column in the free monthly, the Ka'ū Calendar which highlights native species and ecosystems found in Ka'ū, discusses threats to their health, and projects that aim to preserve them. The first column was about watersheds, the second about native birds and the bird surveys.
  - We continue to work with UH Hilo fellows from the PRISM program on using Kaiholena as a regular field site for the implementation of their standards-based, environmental education program.
  - Hosted professional photographer, John DeMello, at Ka'ū Preserve.
- 2009**
- Led eight volunteer workdays at Kaiholena involving threat abatement and Preserve maintenance. Activities included: road maintenance, digging drainages for erosion control, monitoring outplantings, and weed sweeps. Up to eight people participated in each volunteer work day.
  - Coordinated Hawai'i Audubon Society's Christmas Bird Counts at Keauhou-Ka'ū. Twenty-four people participated in the count, which included hearing a family of endangered 'Akiapola'au.
  - Held an open house at the Ka'ū Field Office for conservation supporters within the community.
  - Displayed an information booth at the Ka'ū High School Ho'olaulea at Punalu'u.
  - Presented Ka'ū Natural Resource Management to the Ka'ū community for the Ka'ū Community Development Plan empowerment workshop.
  - Coordinated songwriters and musicians (including Grammy award winner Daniel Ho) for a site visit to Kaiholena. The song "Kaiholena" was produced after the visit and can be heard on Daniel Ho and Tia Carrere's CD: He Nani.
  - Displayed an information booth at the UH Hilo Earth Day Fair.
  - Hosted the Hawai'i Youth Conservation Corps who assisted TNC with weed control and Preserve maintenance projects.
  - Coordinated 'Imi Pono No Ka 'Āina environmental program for a service learning projects at Kaiholena.
  - Hosted Pacific University students in a service learning project at Kāhilipali.
  - Coordinated UH West Hawai'i field trip at Kaiholena
  - Hosted a Ka'ū teacher's workshop at Kaiholena in coordination with the Three Mountain Alliance.
  - Assisted in the initiation of the Jr. Forest Team Program at Ka'ū High School in collaboration with Hawai'i Community College.
  - Donated a prize for the new category "most pounds of pig procured" to the annual hunting tournament in Ka'ū.

- 2010**
- Sierra Club members
  - UHH Geography class (service learning trip)
  - Ka'ū Lokahi Treatment Center members
  - Kanu O Ka 'Āina 1st and 2nd graders
  - Friends of Hawai'i Volcanoes National Park
  - DOE island-wide Kupuna group
  - University of Virginia Semester at Sea
  - Kamehameha Schools 1953 Kupuna group
  - Visiting preserve managers group from China
  - Assisted with coordination of Audubon Society's 2009 Christmas bird counts.
  - Hosted YCC Vista team for 2 weeks, assisted TNC staff with various management projects.
  - Hosting year-long YCC intern, Desiree Awong, through stimulus funding from the State.
  - Participated in UH Hilo's and Kona's 2010 Earth Day fairs.
  - Assisted with Children in Nature Project with TMA, DOFAW, and Colorado State.
  - Co-hosted the Imi Pono No Ka 'Aina program for a week-long, 28-mile hike along the Ka'ū coastline. The student program alumni learned the cultural and natural resources of the area.
  - Hosted the Ka'ū High School biology class, in cooperation with the TMA.
  - We donated prizes for two annual hunting tournaments in Ka'ū; the Jungle Express and Hui 'O Pua'a.

- 2011**
- HCC PIPES interns (work service);
  - Two UHH Geography classes (service learning trips);
  - UC Berkeley Pteridologists Society in September, resulting in a species inventor
  - Colorado State University pasture reforestation project volunteers outplanted three acres in October.
  - Hosted HYCC Vista team for one week in Ka'ū who assisted TNC staff with various management objectives.
  - Hosted two RYCC interns, Kyra Boyle and Ryan McDaniel, and PIPES intern James Akau.
  - TNC field staff attended a Hawaiian language training totaling 48 hours over the course of six months.
  - Hosted National Park Service Interpretive Ranger hike at Kaiholena.
  - Increased public support for conservation projects by attending community/key people meetings in Ka'ū.
  - Coordinated coqui frog eradication group in Ka'ū with the cooperation of DOFAW Coqui
  - Coordinator Raymond McGuire and the community group O Ka'ū Kakou.
  - Participated in Ka'alu'alu beach clean-up.
  - Co-hosted with the Imi Pono No Ka 'Aina program for a visit to the Preserve.
  - Donated prizes for two annual hunting tournaments in Ka'ū: the Jungle Express and Hui 'O Pua'a.
  - In partnership with TMA, hosted an information booth and participated in weigh-in at Jungle Express tournament.

### **Goal 6 - Watershed Partnership**

To assist the long-term effective management of the native ecosystems of the Ka'ū region by participating in the Three Mountain Alliance, a coordinated partnership of landowners and other partners.

#### **Three Mountain Alliance (TMA)**

- 2007** On June 5, the TMA finalized a watershed management plan that included a planning boundary for the partnership, maps of the physical features and land ownership in the region. The plan also included identification and assessment of the primary threats to the biological and cultural resources of the watershed area, and descriptions of the conservation actions planned. In addition, TNC hired a full-time Ka'ū Field Representative position to work primarily with the TMA partnership
- 2007** Assist NPS/State in site survey for optimum ungulate fencing. In cooperation with the NPS, the State and Kamehameha Schools, a site survey for optimum large-scale ungulate fencing will be conducted. Strategies to remove ungulates from remote areas and to enhance ungulate hunter access will be identified and implemented.
- 2008** TMA partners agree to use CAP process for Ka'ū – Kapāpala Mgmt area planning.

- 2008** TMA management plan finalized.
- 2009** Participated in Keauhou, Kulani, and South Kona Forest Bird Surveys
- 2009 - 2011** Continued to assist writing the Ka'ū-Kapāpala Management Area section of the TMA Weed Management Plan, and assisted with the completion of the overall plan.
- 2010** Assisted DOFAW with outplanting Silverswords in the Kapāpala 10-acre enclosure.
- 2010** Assisted the community group O Ka'ū Kakou in coordinating a coqui frog eradication group in Ka'ū, with the cooperation of DOFAW Coqui Coordinator, Raymond McGuire.
- 2011** Work with partners to develop multiple public access routes to Ka'ū forest. Met with DOFAW, Na Ala Hele, and affected land owners to promote adoption of forest access easement.
- 2011** Conducted forest edge survey for feral cattle with DOFAW State Forestry Manager.
- Assist DOFAW with the development of a watershed management plan for Ka'ū-Kapāpala.**
- 
- 2009 - 2010** Drafted a Nā'ālehu Forest Access Plan for increased public access along the forest edge west of the Kaiholena unit. Submitted to DOFAW Watershed Planner, Lisa Ferrentinos. Met with affected private landowners who are in favor of the project.
- 2011** Participated in Forest Bird project site visit and planning meetings.
- Work to address mauka conservation issues by participating in the Ka'ū CDP process.**
- 
- 2009 - 2010**
- TNC toured the consultant team and assisted in preparation of community summit luau.
  - TMA, DOFAW, NPS, and TNC participated in the community summits and charrettes, provided information and planning ideas.
  - TNC staff attended Lt. Governor Aiona and Mayor Kenoi's visits to Nā'ālehu.
  - TNC staff served as Co-chair for the Ka'ū Community Development Plan Steering Committee.
- 2011** Staff attended CDP project update meetings
- Hawaii Volcanoes National Park**
- 
- 2008** Assist NPS with Kahuku Management Planning - continue working with NPS team on ZT weed goals.
- 2008** Develop collaborative fencing and ungulate control strategy for Ka'ū/Kapāpala

## Appendix 2. Native Natural Communities Of Waikamoi Preserve

Natural Community (common and scientific names)	Heritage Global Rank*
Koa/‘Ōhi‘a Montane Mesic Forest <i>Acacia koa/Metrosideros polymorpha</i> Montane Mesic Forest	G1
Koa/‘Ōhi‘a Montane Wet Forest <i>Acacia koa/Metrosideros polymorpha</i> Montane Wet Forest	G3
‘Ōhi‘a Montane Wet Forest <i>Metrosideros polymorpha</i> Montane Wet Forest	G3
‘Ōhi‘a Lowland Wet Forest <i>Metrosideros polymorpha</i> Lowland Wet Forest	G3

\* Key to Heritage Global Ranks:

G1 = Critically imperiled globally (typically 1-5 current occurrences).

G3 = Moderately imperiled globally or restricted in range (typically 21-100 current occurrences).

### Appendix 3. Draft List of Native Plants of the Kaiholena Unit

Scientific Name	Hawaiian / Common Name
<i>Adenophorus tripinnatifidus</i>	Wahine-Noho-Mauna
<i>Alyxia oliviformis</i>	Maile
<i>Antidesma platphyllum</i>	Akole
<i>Asplenium contiguum</i>	N/A
<i>Asplenium lobulatum</i>	Pi'i-Lau-Manamana
<i>Asplenium unilaterale</i>	Pamoho
<i>Astelia menziesiana</i>	Pa'inui
<i>Athyrium microphyllum</i>	Akole
<i>Broussaisia arguta</i>	Kanawau
<i>Cheirodendron trygynum</i>	Olapa
<i>Cibotium glaucom</i>	Hapu'u Pulu
<i>Cibotium hawaiiense</i>	Hapu'u Meu
<i>Cibotium menziesii</i>	Hapu'u 'I'i
<i>Clermontia hawaiiensis</i>	Oha Kepau
<i>Clermontia montis-loa</i>	Oha Wai
<i>Clermontia parviflora</i>	Oha Wai
<i>Cocculus trilobus</i>	Huehue
<i>Coniogramme pilosa</i>	Lo'olu (Fern)
<i>Coprosma ochracea</i>	Pilo
<i>Coprosma rhyrachocarpa</i>	Pilo
<i>Cyrtandra lysiosepala</i>	Ha'iwale
<i>Cyrtandra platyphylla</i>	Ilihia
<i>Dicranopteris linearis</i>	Uluhe
<i>Diplazium sandwichianum</i>	Hoi'o
<i>Dodonea viscosa</i>	A'ali'i
<i>Elaphoglossum crassifolium</i>	Stag's Tongue
<i>Elaphoglossum paleaceum</i>	N/A
<i>Elaphoglossum wawrae</i>	Ekaha, Laukahi-nunui
<i>Freycinetia arborea</i>	Ie'ie
<i>Grammtis hookeri</i>	Maku'e-Lau-Li'i
<i>Grammtis tenella</i>	Kolokolo
<i>Hedyotis centranthoides</i>	N/A
<i>Hedyotis terminalis</i>	Manono
<i>Huperziaserrata</i>	Wawae'iole
<i>Ilex anomala</i>	Kawa'u
<i>Korthalsella (sp?)</i>	Hawaiian Mistletoe
<i>Labordia hedyosmifolia</i>	Kamakahala
<i>Lycopodiella cernua</i>	Wawae'iole
<i>Lycopodiella venustulum</i>	Wawae'iole
<i>Machaerina angustifolia</i>	Uki
<i>Marratia douglasii</i>	Pala
<i>Mecodium recurvum</i>	Ohia Ku
<i>Melicope clusiifolia</i>	Alani
<i>Metrosideros polymorpha</i>	Ohia lehua
<i>Microlepis strigosa</i>	Palapalai
<i>Myrsine lessertiana</i>	Kolea
<i>Nephrolepis cordifolia</i>	Kupukupu

Appendix 3 (cont'd). Draft Native Plant List of Kaiholena Unit

<i>Ophioderma pendulum subsp. Falcatum</i>	N/A
<i>Peperomia hyopleuca</i>	Ala'alawainui
<i>Peperomia membranacea</i>	Ala'alwainui
<i>Perrottetia sandwicensis</i>	Olomea
<i>Pipturs albutis</i>	Mamaki
<i>Pittosporum confertiflorum</i>	Ho'awa
<i>Pittosporum hawaiiense</i>	Ho'awa
<i>Pneumatopteris sandwicensis</i>	Ho'i'o-Kula
<i>Polypodium pellucidum var. pellucidum</i>	N/A
<i>Psilotum complanatum</i>	Moa
<i>Psychotria (sp?)</i>	Kopiko
<i>Sadleria cyatheoides</i>	Ama'u
<i>Scaevola chamissoniana</i>	Naupaka-Kuahiwi
<i>Selaginella arbuscula</i>	Lepelepe-A-Moa
<i>Smilax melastomifolia</i>	Hoi kuahiwi
<i>Sphaerocionium lanceolatum</i>	Palai-Hinahina
<i>Sphenomeris chinensis</i>	Pala'a
<i>Trematolobelia wimmeri</i>	N/A
<i>Vaccinium calycinum</i>	Ohelo Kala'au
<i>Vandenboshcia davallioides</i>	N/A

#### Appendix 4. Rare Plants of Ka'ū Preserve (or vicinity)

Species	Federal Status*	Heritage Global Rank**
<i>Asplenium fragile</i> var <i>insulare</i>	LE	G5T1
<i>Clermontia lindseyana</i>	LE	G1
<i>Cyanea stictophylla</i>	LE	G1
<i>Cyanea tritomantha</i>	C	G1
<i>Lobelia hypoleuca</i>	-	G3
<i>Melicope zahlbruckneri</i>	LE	G1
<i>Nothocestrum breviflorum</i>	LE	G1
<i>Phyllostegia floribunda</i>	C	G1
<i>Phyllostegia velutina</i>	LE	G1
<i>Phyllostegia vestita</i>	SOC	G2
<i>Pritchardia lanigera</i>	SOC	G1
<i>Trematolobelia wimmeri</i>	SOC	G2

\* Key to Federal Status:

Listed Endangered (LE) = Taxa listed as endangered.

Candidate (C) = Taxa for which substantial information on biological vulnerability and threat(s) support proposals to list them as threatened or endangered.

Species of Concern (SOC) = Taxa for which available information meets the criteria for concern and the possibility to recommend as candidate.

\*\* Key to Heritage Global Ranks:

G1 = Critically imperiled globally (typically 1-5 current occurrences).

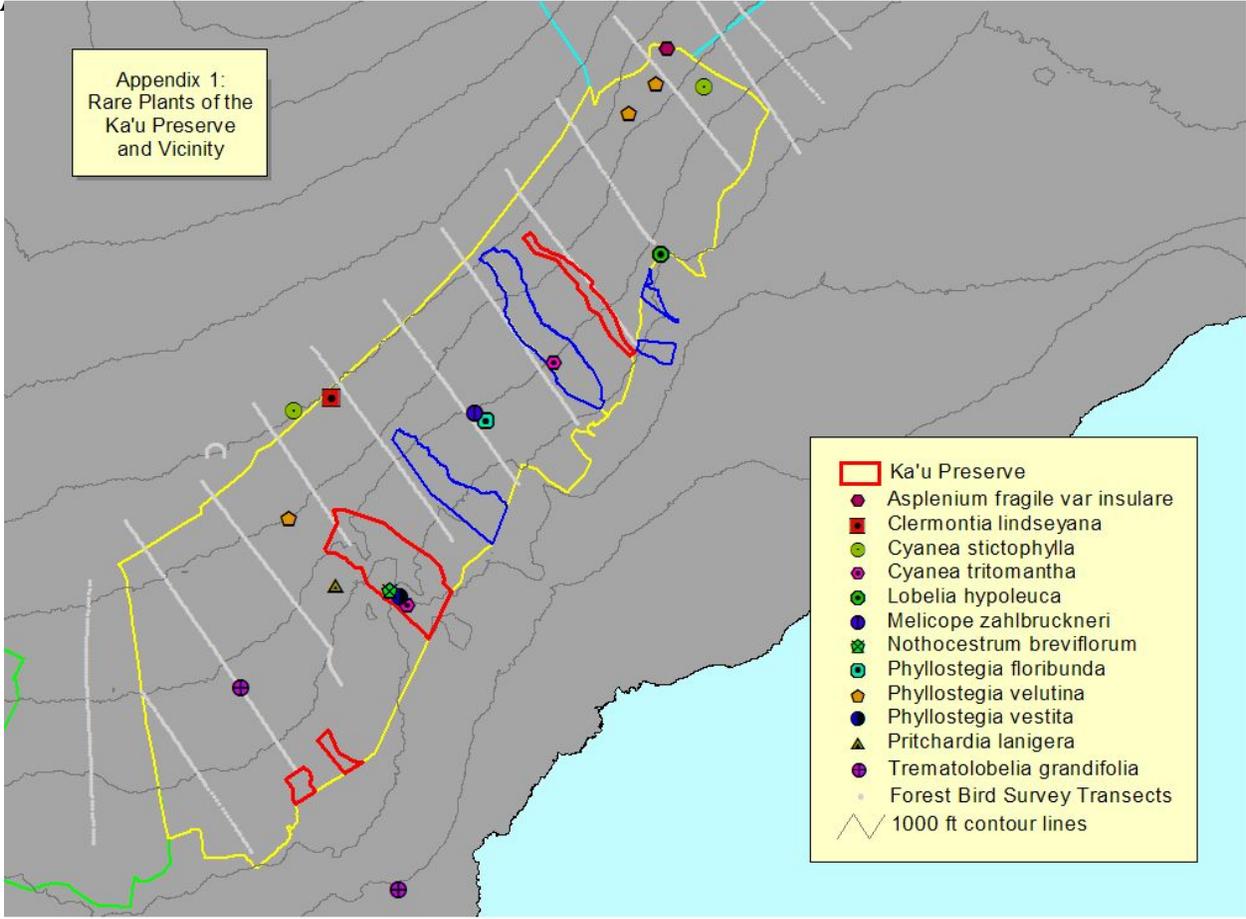
G2 = Imperiled globally (typically 6-20 current occurrences).

G3 = Moderately imperiled globally or restricted in range (21-100 current occurrences).

G5 = Demonstrably widespread, abundant, and secure.

T1 = Subspecific taxa critically imperiled globally. 1-5 occurrences and/or fewer than 1,000 individuals remaining; or more abundant but facing extremely serious threats range-wide.

Appendix 1:  
Rare Plants of the  
Ka'u Preserve  
and Vicinity



## Appendix 6. Rare Vertebrates of Ka'ū Preserve (or vicinity)

Species	Federal Status*	Heritage Global Rank**
<i>Buteo solitarius</i> (Hawaiian Hawk, 'Io)	LE	G2
<i>Corvus hawaiiensis</i> (Hawaiian Crow, 'Alalā)	LE	G1
<i>Hemignathus munroi</i> ('Akiapōlā'au)	LE	G1
<i>Lasiuris cinereus semotus</i> (Hawaiian hoary bat, 'ōpe'ape'a)	LE	G5T2
<i>Loxops coccineus coccineus</i> (Hawai'i 'Ākepa)	LE	G2
<i>Oreomystis mana</i> (Hawai'i Creeper)	LE	G2

\* Key to Federal Status:

Listed Endangered (LE) = Taxa listed as endangered.

\*\* Key to Heritage Global Ranks:

G1 = Critically imperiled globally (typically 1-5 current occurrences).

G2 = Species imperiled globally (typically 6-10 current occurrences).

G5 = Demonstrably widespread, abundant, and secure.

T2 = Subspecific taxa imperiled globally. 6-20 occurrences and/or 1,000-3,000 individuals remaining; or more abundant but facing serious threats range-wide.

## Appendix 7. Rare animals of Ka'ū Preserve and vicinity

